November 8, 2005

TO:

Sree Kumar Design Division

Attention Joe Li

FROM:

Rod H. Kubomoto

they Water Resources Division

RIVER AVENUE STORM DRAIN CITY OF LONG BEACH HYDROLOGY REPORT

In response to your request dated October 5, 2005, this memorandum provides hydrologic information for the watershed tributary to the River Avenue storm drain in the City of Long Beach. The information in this completed hydrology report will assist in developing solutions to the flooding problems along West Arlington Street.

The watershed has a tributary area of 237 acres (0.37 square miles). Approximately 42.6 percent of the watershed is in the City of Long Beach with 57.4 percent in the City of Carson.

As agreed upon in our meeting with Design Division on November 1, 2005, we have included the analyses for the 2-, 5-, 10-, 25-year frequency design storms. The hydrologic models of the watershed were developed using the Watershed Modeling System and the Modified Rational Method. The hydrologic analyses are based on the standards and procedures described in the 1991 Public Works Hydrology/Sedimentation Manual and the 2002 Hydrology Manual Addendum.

Attachments

- A-1. Hydrologic map showing existing drainage area boundaries tributary to the River Avenue storm drain.
- A-2. Aerial photograph showing existing drainage area boundaries tributary to the River Avenue storm drain.
- B-1. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 2-year frequency design storm.

- B-2. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 5-year frequency design storm.
- B-3. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 10-year frequency design storm.
- B-4. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 25-year frequency design storm.
- C. Supporting information including design parameters and street flooding analysis.
- D. Design Division's request dated October 5, 2005.

Summary of Findings

- Flow rates from subareas 10B and 18C represent runoff from a 50-year frequency design storm due to sump conditions for the 10- and 25-year frequency storm analyses only.
- The adequately collected peak flow from a 2-year frequency storm for the area tributary to the River Avenue storm drain is 65 cubic feet per second (cfs).
- The adequately collected peak flow from a 5-year frequency storm for the area tributary to the River Avenue storm drain is 111 cubic feet per second (cfs).
- The adequately collected peak flow from a 10-year frequency storm for the area tributary to the River Avenue storm drain is 150 cubic feet per second (cfs).
- The adequately collected peak flow from a 25-year frequency storm for the area tributary to the River Avenue storm drain is 191 cubic feet per second (cfs).

Sree Kumar November 8, 2005 Page 3



If you have any questions, please contact Jessica Murphy at 458-6133.

JM:ac

C:\Documents and Settings\murphy\Desktop\River Avenue\files\River Ave Memo.doc

Attach.

cc: Water Resources (Araiza, Files)

November 8, 2005

TO:

Sree Kumar

Design Division

Attention Joe Li

FROM:

Rod H. Kubomoto

Water Resources Division

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- B-3. Hydrologic data tables listing subarea sizes, subarea flow rates, and reach flow rates based on adequately collected runoff from a 10-year frequency design storm.
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- The adequately collected peak flow from a 5-year frequency storm for the area tributary to the River Avenue storm drain is 111 cubic feet per second (cfs).
- The adequately collected peak flow from a 10-year frequency storm for the area tributary to the River Avenue storm drain is 150 cubic feet per second (cfs).
- The adequately collected peak flow from a 25-year frequency storm for the area tributary to the River Avenue storm drain is 191 cubic feet per second (cfs).

Sree Kumar November 8, 2005 Page 3

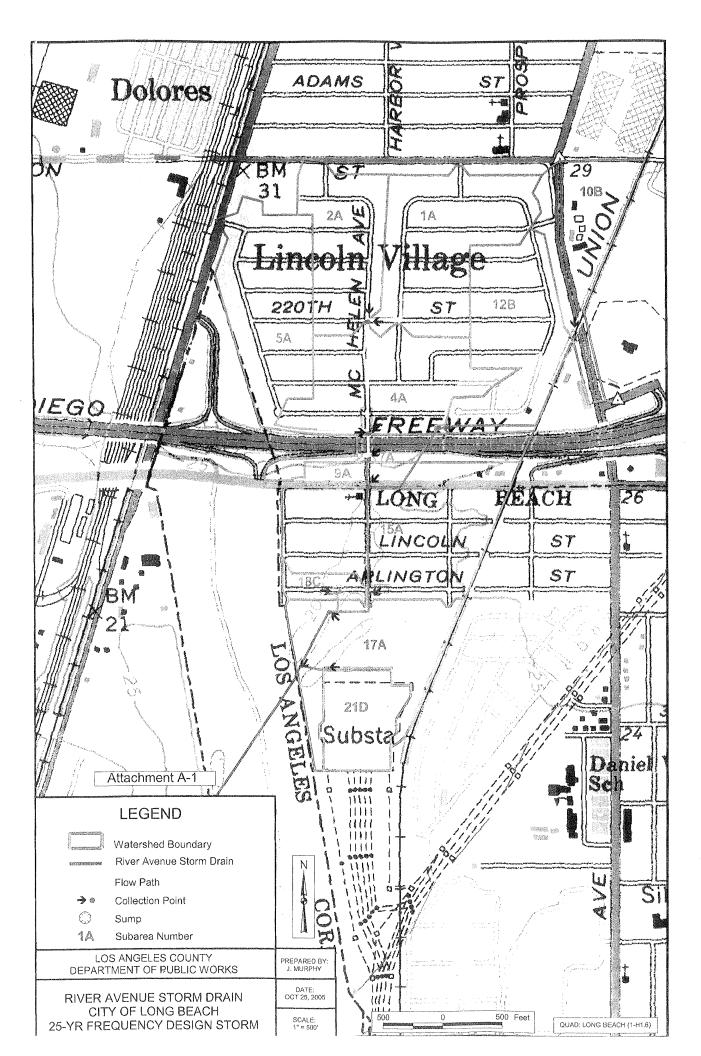
If you have any questions, please contact Jessica Murphy at 458-6133.

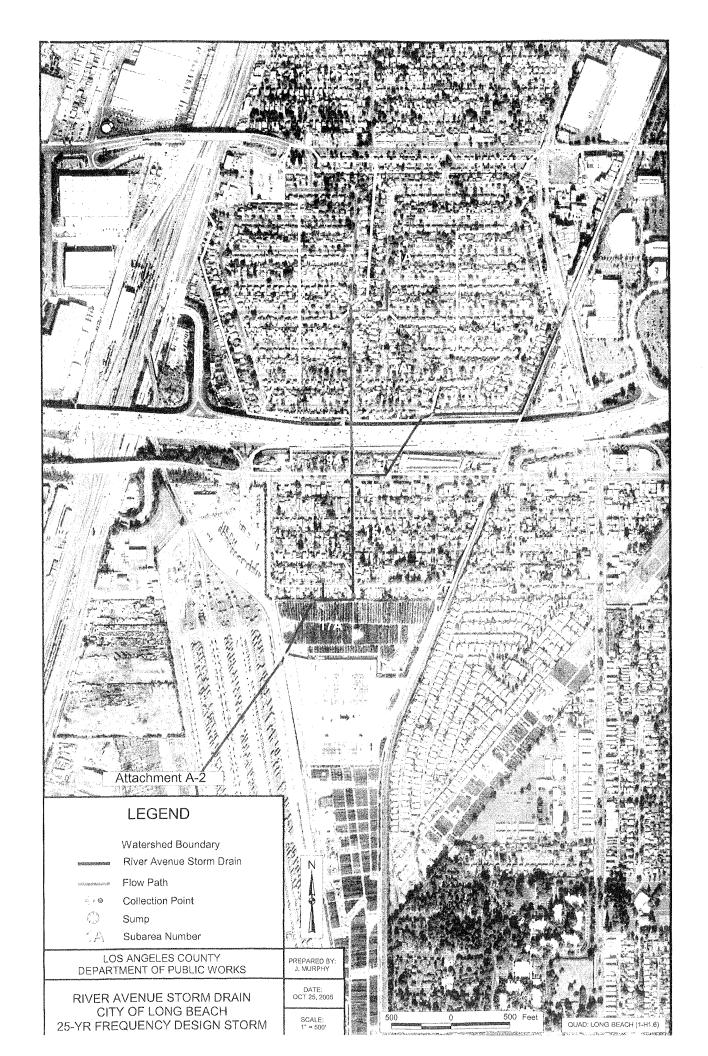
JM:ac

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Attach.

cc: Water Resources (Araiza, Files)





ATTACHMENT B-1 HYDROLOGIC DATA

Project: River Avenue Storm Drain - City of Long Beach

Conveyance Types:

1. Natural Mountain

2. Natural Valley

3. Street

4. Pipe

5. Rectangular Channel

6. Trapezoidal Channel

	Prelim	inary Conve	yance		Ar	ea	Pea	kQ
Reach or	Length	Туре	Size	Slope	Subarea	Total	Subarea ¹	Reach ²
Subarea	(feet)		(feet)		(acres)	(acres)	(cfs)	(cfs)
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Line A								
1A					29.5		10.6	
2A					19.3		6.9	
2A-4A	925	4	2.75	0.0010		48.8		17.6
4A					26.0		9.2	
5A					26.9		9.8	
5A-7A	214	4	3.75	0.0010		101.7		34.6
7A					9.4		4.4	
7A-9A	227	4	3.25	0.0020		111.1		38.8
9A			-		9.0		3.3	
9A - Line B		-	-	_		120.1		41.8
Line B					45.2		14.1	
Line B - 15A	983	4	4.25	0.0010		165.3		55.2
15A					33.1		9.5	
15A-17A	384	4	4.50	0.0010		198.4		61.9
17A					22.5		2.9	
17A - Line C	ia.	74		yes		220.9		63.9
Line C					3.5		0.9	
Line C - Line D	581	4	4.50	0.0010		224.4		64.7
Line D					12.1		1.6	
Line D - Outlet	-	_	-			236.5		65.4
Line B								
10B					19.2		8.2	
10B -12B	1623	4	2.00	0.0040		19.2		8.2
12B					26.0		6.7	
12B - Line A	857	4	2.25	0.0020		45.2		14.1

¹Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

²Peak flow rate at the top of the reach for design of the conveyance.

³Flows resulting from a 50-year frequency rainfall

ATTACHMENT B-1 HYDROLOGIC DATA

Project: River Avenue Storm Drain - City of Long Beach

Conveyance Types:

1. Natural Mountain

2. Natural Valley

3. Street

4. Pipe

5. Rectangular Channel

6. Trapezoidal Channel

Reach or	Prelim	inary Conve	yance		Ar	ea	Pea	k Q
Subarea	Length	Type	Size	Slope	Subarea	Total	Subarea ¹	Reach ²
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18C - Line A	253	4	2.00	0.0010		3.5		0.9
Line D								
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¹Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

Peak flow rate at the top of the reach for design of the conveyance.

Flows resulting from a 50-year frequency rainfall

ATTACHMENT B-2 HYDROLOGIC DATA

Project: River Avenue Storm Drain - City of Long Beach

Conveyance Types:

1. Natural Mountain

2. Natural Valley

3. Street

4. Pipe

5. Rectangular Channel

6. Trapezoidal Channel

Deach	Prelim	inary Conve	yance		Ar	ea	Pea	ik Q
Reach or Subarea	Length	Туре	Size	Slope	Subarea	Total	Subarea ¹	Reach ²
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4A					26.0		16.4	
5A					26.9		17.0	
5A-7A	214	4	4.50	0.0010		101.7		61.5
7A					9.4		7.0	
7A-9A	227	4	4.00	0.0020		111.1		68.1
9A					9.0		5.0	
9A - Line B	_					120.1		72.8
Line B					45.2		22.3	
Line B - 15A	983	4	5.25	0.0010		165.3		94.0
15A					33.1		14.3	
15A-17A	384	4	5.50	0.0010		198.4		105.0
17A					22.5		4.4	
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Line C - Line D	581	4	5.50	0.0010		224.4		109.5
Line D					12.1		2.4	
Line D - Outlet	-	-	-			236.5		110.9
Line B								
10B			***************************************		19.2		13.3	
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12B					26.0	***************************************	10.1	
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¹Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

Peak flow rate at the top of the reach for design of the conveyance.

Flows resulting from a 50-year frequency rainfall

ATTACHMENT B-2 HYDROLOGIC DATA

Project: River Avenue Storm Drain - City of Long Beach

Conveyance Types:

1. Natural Mountain

2. Natural Valley

3. Street

4. Pipe

5. Rectangular Channel

6. Trapezoidal Channel

Decel or	Prelim	inary Conve	yance	2010-2010-20-20-20-20-20-20-20-20-20-20-20-20-20	An	ea	Pea	
Reach or Subarea	Length	Type	Size	Slope	Subarea	Total	Subarea ¹	Reach ²
Subarea	(feet)		(feet)		(acres)	(acres)	(cfs)	(cfs)
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Line C								
18C					3.5		1.6	
18C - Line A	253	4	2.00	0.0010		3.5		1.6
Line D								
21D					12.1		2.4	
21D - Line A	303	4	2.00	0.0024		12.1		2.4
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¹Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

²Peak flow rate at the top of the reach for design of the conveyance.

³Flows resulting from a 50-year frequency rainfall

#### **ATTACHMENT B-3** HYDROLOGIC DATA

Project: River Avenue Storm Drain - City of Long Beach

Conveyance Types:

1. Natural Mountain

2. Natural Valley

3. Street

4. Pipe

5. Rectangular Channel

6. Trapezoidal Channel

D I	Prelim	inary Conve	yance		Ar	ea	Pea	
Reach or	Length	Туре	Size	Slope	Subarea	Total	Subarea ¹	Reach ²
Subarea	(feet)		(feet)		(acres)	(acres)	(cfs)	(cfs)
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Line A								
1A					29.5		23.5	
2A					19.3		15.4	
2A-4A	925	4	3.75	0.0010		48.8		38.9
4A		_			26.0		22.7	
5A					26.9		21.6	
5A-7A	214	4	5.00	0.0010		101.7		80.1
7A					9.4		9.2	
7A-9A	227	4	4.50	0.0020		111.1		88.6
9A					9.0		6.5	
9A - Line B	-	-	ped .			120.1		94.6
Line B					45.2		36.8	
Line B - 15A	983	4	6.00	0.0010		165.3		129.7
15A					33.1		17.8	
15A-17A	384	4	6.00	0.0010		198.4		143.5
17A					22.5		5.7	
17A - Line C	,,,,		~	_		220.9		147.4
Line C					3.5		4.5 ³	
Line C - Line D	581	4	6.25	0.0010		224.4		148.4
Line D					12.1		3.1	
Line D - Outlet				PM		236.5		150.4
Line B								
10B					19.2		25.8	
10B -12B	1623	4	2.50	0.0040		19.2		25.8 ³
12B					26.0		12.6	
12B - Line A	857	4	3.25	0.0020		45.2		36.8

¹Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

Peak flow rate at the top of the reach for design of the conveyance.

Flows resulting from a 50-year frequency rainfall

### **ATTACHMENT B-3** HYDROLOGIC DATA

**Project: River Avenue Storm Drain – City of Long Beach** 

Conveyance Types:

1. Natural Mountain

2. Natural Valley

3. Street

4. Pipe

5. Rectangular Channel

6. Trapezoidal Channel

Reach or	Prelim	inary Conve	yance		Are	ea	Pea	k Q
Subarea	Length	Type	Size	Slope	Subarea	Total	Subarea ¹	Reach ²
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18C					3.5		4.5	
18C - Line A	253	4	2.00	0.0010		3.5		4.5 ³
Line D								***************************************
21D					12.1		3.1	
21D - Line A	303	4	2.00	0.0024		12.1		3.1

¹Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

Peak flow rate at the top of the reach for design of the conveyance.

Flows resulting from a 50-year frequency rainfall

### **ATTACHMENT B-4** HYDROLOGIC DATA

Project: River Avenue Storm Drain - City of Long Beach

Conveyance Types:

1. Natural Mountain

2. Natural Valley

3. Street

4. Pipe

5. Rectangular Channel

6. Trapezoidal Channel

	Prelim	inary Conve	yance	magnas ou universe sum on our simple a suit Messa	Ar	ea	Pea	k Q
Reach or Subarea	Length	Type	Size	Slope	Subarea	Total	Subarea ¹	Reach ²
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Line A					LEGOSDOMINOS LA			
1A					29.5		29.9	
2A					19.3		20.3	
2A-4A	925	4	4.25	0.0010		48.8		50.2
4A					26.0		31.9	
5A					26.9		27.5	
5A-7A	214	4	5.50	0.0010		101.7		105.6
7A					9.4		12.6	
7A-9A	227	4	5.00	0.0020		111.1		117.0
9A					9.0		9.2	
9A - Line B		_	-			120.1		125.4
Line B					45.2		40.7	
Line B - 15A	983	4	6.50	0.0010		165.3		163.8
15A					33.1		23.3	
15A-17A	384	4	6.75	0.0010		198.4		182.2
17A					22.5		8.6	
17A - Line C	No.	140	_	-		220.9		188.6
Line C					3.5		4.5 ³	
Line C - Line D	581	4	6.75	0.0010		224.4		189.8
Line D					12.1		3.1	
Line D - Outlet	-	-	-	-		236.5		191.4
Line B								
10B					19.2	a stinute and a state of the st	25.8	
10B -12B	1623	4	2.50	0.0040		19.2		25.8 ³
12B					26.0		16.7	
12B - Line A	857	4	3.50	0.0020		45.2		40.7

Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

²Peak flow rate at the top of the reach for design of the conveyance.
³Flows resulting from a 50-year frequency rainfall

### ATTACHMENT B-4 HYDROLOGIC DATA

Project: River Avenue Storm Drain - City of Long Beach

Conveyance Types:

1. Natural Mountain

2. Natural Valley

3. Street

4. Pipe

5. Rectangular Channel

6. Trapezoidal Channel

Doooh or	Prelim	inary Conve	yance		Are	ea	Pea	k Q
Reach or Subarea	Length	Type	Size	Slope	Subarea	Total	Subarea ¹	Reach ²
Subarea	(feet)		(feet)		(acres)	(acres)	(cfs)	(cfs)
Line C		and the state of t						
18C					3.5		4.5	***************************************
18C - Line A	253	4	2.00	0.0010		3.5		4.5 ³
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21D					12.1		3.1	
21D - Line A	303	4	2.00	0.0024		12.1		3.1
		***************************************				977774		074F03E79XT0360A7H076G959M14X6H2

¹Peak flow rate from the subarea that can be proportioned (Q/A) for catch basin design within the subarea (see the Department's "Hydraulic Design Manual").

²Peak flow rate at the top of the reach for design of the conveyance.

³Flows resulting from a 50-year frequency rainfall

## ATTACHMENT C SUPPORTING INFORMATION

River Avenue Storm Drain - City of Long Beach

#### Design Parameters

This hydrology meets the policies and procedures established in the Public Works Hydrology Manual dated December 1991 and the 2002 Hydrology Manual Addendum.

The total watershed size is 237 acres. The assumed ultimate development in the watershed is 74 percent residential, 18 percent commercial/industrial and 8 percent nurseries.

As-built storm drain plans for the River Avenue storm drain were reviewed to determine the proper drain alignment and to aid in subarea delineation and routing. Storm drain slopes were obtained from as-built plans and used in the hydrologic model.

All reported flow rates are adequately collected runoff from 2-, 5-, 10- and 25-year frequency design storms.

Adequate collection assumes that the drainage system collects all incoming surface flows and that runoff will flow out of its appropriate subarea only at the collection point. It is assumed that any catch basins, culverts, and drains within the watershed have sufficient capacity to capture the runoff from 2-, 5-, 10-, and 25-year frequency design storms.

## ATTACHMENT C (Con't) SUPPORTING INFORMATION

River Avenue Storm Drain - City of Long Beach

Street Flooding Analysis - Existing Conditions

Street flow depths shown below are based on a 2-year frequency rainfall.

*Street flow depths:

A – Below top of curb

B – Above top of curb

C – Above property line

		Ex	isting Condition	ons	and the second s	AND THE PROPERTY OF THE PROPER
Reach or		Street Flo	Por	nding		
Subarea	Α	A B C D				Duration
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Line A						
2A-4A		X				
5A-7A			X			

## ATTACHMENT C (Con't) SUPPORTING INFORMATION

River Avenue Storm Drain - City of Long Beach

<u>Street Flooding Analysis – Existing Conditions</u>

Street flow depths shown below are based on a 5-year frequency rainfall.

*Street flow depths:

A – Below top of curb

B – Above top of curb

C – Above property line

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Reach or		Street Flow Depth* Ponding						
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Line A								
2A-4A			X					
5A-7A			X					

## ATTACHMENT C (Con't) SUPPORTING INFORMATION

River Avenue Storm Drain - City of Long Beach

Street Flooding Analysis - Existing Conditions

Street flow depths shown below are based on a 10-year frequency rainfall.

*Street flow depths:

A – Below top of curb

B – Above top of curb

C – Above property line

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Line A								
2A-4A			X					
5A-7A			X					
	The second secon							

# ATTACHMENT C (Con't) SUPPORTING INFORMATION

River Avenue Storm Drain - City of Long Beach

Street Flooding Analysis - Existing Conditions

Street flow depths shown below are based on a 25-year frequency rainfall.

*Street flow depths:

A – Below top of curb

B – Above top of curb

C – Above property line

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Reach or		Street Flow Depth* Pond						
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Line A								
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5A-7A			X					
			The state of the s					

## ATTACHMENT D REQUEST FROM DESIGN DIVISION

October 5, 2005

TO:

Rod H. Kubomoto

Water Resources Division

....

Attention Iraj Nasseri

For FROM:

Sree Kumar

Design Division

#### RIVER AVENUE STORM DRAIN REQUEST FOR UPDATED HYDROLOGY REPORT PCA DLBCH15727

Please provide the updated hydrology for the River Avenue Storm Drain located in the City of Long Beach (T.G. 764 J-7, 765 A-7, 794 J-1, 795 A-1). Public Works is working as a consultant for the City of Long Beach needed to provide a Project Design Concept to mitigate flooding in the subject area. It should be noted that the City drain outlets into Dominguez Channel. The existing channel in this vicinity is tide-influenced with an outlet hydraulic control elevation of 12.4 feet mean sea level.

Attached are the following for your use and reference:

- Site Map
- As-built Plans (Drawing No. B-1938, provided by the City of Long Beach)
- Existing Hydrology Report (provided by the City of Long Beach)
- Existing Hydrology Map (provided by the City of Long Beach)

Per our discussion between Iraj Nasseri of your staff and Mike Soliman of Design Division, Water Resources Division shall complete the following tasks within the budget of \$15,000:

- Provide updated hydrological models based on the most current modified rational hydrological methods to identify appropriate design hydrology for various design frequencies. Please complete the updated Hydrology Report by October 27, 2005.
- Based on the results of the Hydrology Report, develop, if needed, analytical what if scenarios for the purpose of designing detention facilities (linear or other multi-use options).

If you have any questions, please contact Joe Li at Extension 7839 or Patrick Holland at Extension 7930.

PH:sr

D-2/P /DDPUB/DRAINAGE/PROJECTSD2/LONGBEACHSPECIALPROJECT/HYDROLOGYREQUEST

Attach.

cc: Design (Li)